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AUTHOR Allen, Roger J.
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ABSTRACT

This study evaluated the efficacy of the undergraduate service program "Controlling Stress & Tension" at the University of Maryland in terms of improving the health status of participants across biomedical stress reactivity and psychometric variables. Six hundred fifty-three participants were compared to 264 control subjects for pre- to post-program changes across the four psychophysiological stress response variables of frontalis EMG, pulse rate, pulse amplitude, and skin potential response as well as three psychometric variables including Type A/B behavior, locus of control, and manifest anxiety. Post-test analysis revealed that program participants displayed significantly lower measured stress activity for frontalis muscle tension, pulse amplitude, and skin potential response compared to control subjects. Psychometric changes included significantly reduced manifest anxiety and a significant locus of control shift to internality in program participants compared to controls. The results indicate that, in relation to several measures of biological integrity and mental well-being, the program under investigation was producing a significant, beneficial impact on human health via the precursors to psychosomatic disease. (Author/JD)

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Author : Roger J. Allen, Ph.D.
Director of Research
& Graduate Studies

Affiliation: Department of Health Education
University of Maryland
College Park, Maryland
20742

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ABSTRACT

This study evaluated the efficacy of the undergraduate service program in "Controlling Stress & Tension" at the University of Maryland, in terms of improving the health status of participants across biomedical stress reactivity and psychometric variables. 653 participants were compared to 264 control subjects for pre to post-program changes across the four psychophysiological stress response variables of frontalis EMG, pulse rate, pulse amplitude, and skin potential response as well as three psychometric variables including Type A/B behavior, locus of control, and manifest anxiety. Post-test analysis revealed that program participants displayed significantly lower ($p \leq .05$) measured stress reactivity for frontalis muscle tension, pulse amplitude, and skin potential response compared to controls. Psychometric changes included significantly reduced ($p \leq .05$) manifest anxiety and a significant ($p \leq .05$) locus of control shift to internality in program participants compared to controls. The results lead the author to conclude that in relation to several measures of biological integrity and mental well-being, the program under investigation was producing a significant, beneficial impact on human health via the precursors to psychosomatic disease.

INTRODUCTION

One of the most significant contributing factors to the overall incidence of somatic disease in this culture is the experience of human stress. It is therefore not surprising that stress management education has found a viable place in the health education domain.

The department of health education at the University of Maryland has offered undergraduate and continuing adult education service programs in the area of Controlling Stress & Tension since 1974. Enrollment has expanded from an initial figure of 25 students per semester to a current participation value of over 750 students per semester. The current academic structure, topical scope, activities, and instructional materials developed for this program now serve as principle models for implimenting college-level service course offerings and workshops in the area of stress management. The questions now to be addressed involve the program's efficacy. Specifically (and apart from academic objectives), is this program impacting the health of its participants in a positive direction in relation to the biomedical and psychometric predisposing factors to psychosomatic disease? In other words, is this model program effectively equiping participants to manage stress in their lives?

PURPOSE

The purpose of this investigation was to evaluate the biomedical and psychometric efficacy of a college-level Controlling Stress & Tension program at the University of Maryland, for positively impacting human health through minimizing the experience of stress and reducing measured activity of precursors

to psychosomatic disease. Specifically, this study compared changes in participants of the stress management service program to control subjects, in stress reactivity scores across frontalis EMG (muscle tension), pulse rate, pulse amplitude, and skin potential response and psychometric measures of Type A/B behavior, locus of control, and manifest anxiety.

THE PROGRAM

The program is presented as a three credit-hour undergraduate course offering (HLTH 285) for both regular university and continuing adult education credit. It currently satisfies a "General University Requirement" for coursework in the "Social and Behavioral Sciences" diversity area, making credit for the course directly applicable to the degree requirements of all undergraduate academic programs on campus.

The program is not designed to serve as therapeutic intervention into specific stress related problems. Rather, it is an educational experience designed to increase student participants' understanding of stress and provide them with practical tools for its effective control.

By design, program presentations provide sound theoretical grounding as well as practical skills. The following comprehensive course objectives reflect the academic/pragmatic balance in the program:

1) Establish a sound theory and knowledge base regarding the nature, predisposing factors, mechanisms, and effects of human stress.

2) Provide opportunities for student self-assessments of manifestations of predisposing factors in the etiology of stress-related problems.

3) Establish a theoretical and empirically validated model for understanding mechanisms of intervention and evaluation of diverse stress control strategies and techniques.

4) Provide stress management skill training and in-class participation, practice,and efficacy follow-up in diverse forms of stress control modalities.

The selection and order of topical presentation follow the Psychosomatic Model, of Allen and Hyde [1], as a structural outline. Areas presented first, address the development of stress-related psychosomatic disease in order to provide a knowledge base and theoretical understanding of human stress, its precursors, and mechanisms. Topics covered include Cannon's "fight or flight response", Selye's "general adaptation syndrome", psychosomatic theory, stressors and life events, personality factors in illness, psychophysiology of the stress response, and stress and disease. Once a sound knowledge base and theoretical framework has been established, the second half of the program presents and has participants practice diverse skills for stress intervention and management. These strategies include social engineering, cognitive reappraisal, relaxation theory, meditation, Jacobsonian progressive neuromuscular relaxation, calming response, and selective awareness techniques. In addition, each participant receives 4 to 6 twenty minute training sessions of frontalis EMG biofeedback training. Student activities presented in class may be found in Investigations in Stress Control, by Allen and Hyde [2].

A more detailed description of specific program topics and activities may be secured by contacting the author.

METHOD

Subjects used in this investigation included 653 program participants (297 males and 356 females) and 264 controls (117 males and 147 females). The participants were all enrolled in Controlling Stress and Tension classes (HLTH 285) at the University of Maryland, College Park campus. Control Subjects were drawn from students enrolled in Personal and Community Health (HLTH 140) and Drug Use and Abuse (HLTH 106) classes at the same institution. Age range for all subjects was 18 to 59 years with a mean age of 22. Subject class enrollment and all data collection was carried out between the spring semester of 1978 and the first summer session of 1980.

To assess the biomedical efficacy of the program, all subjects' stress reactivity was measured pre and post across the dependent psychophysiological response variables fo frontalis EMG, pulse rate (beat to beat interval), pulse amplitude, and skin potential response. Each parameter was assessed for baseline value, and for two dimensions of response to a rapid onset stressor, response amplitude and duration. Specific insturmentation, measurement, and stimulus presentation protocol followed guidelines established by Allen [3]. Following an eight minute stabilization period, prestimulus baseline measurements were made on all response parameters by averaging 20 successive 6 second measures. A rapid onset stressor was then presented to the subject; a 2,700 hz. tone, at 90 dB, for 0.7 seconds duration. Response amplitude was operationalized as the peak 6 second poststimulus value prior to return to baseline. Response duration was measured as the time interval required by each parameter for the subject to return to a baseline value following stumulus presentation, expressed as the number of elapsed 6 second intervals prior to observance of the prestimulus average.

All biomedical measurements were carried out at the Psychophysiological Research Laboratory of the department of health education at the University of Maryland, College Park campus. All measurements were made with the aid of a fully digitized, programable Coulbourn Modular Instrument System. Frontalis EMG was picked-up via three Beckman silver/silver chloride electrodes positioned in a linear array on the forehead, 2 cm. above the browline, with an interelectrode distance of 3 cm., and a center ground. EMG measures were expressed as the average amplitude in microvolts for the 6 second measurement interval. Pulse rate and amplitude were transduced with an infrared photoplethysmograph placed on the volar surface of the second digit's distal phalanx of the subject's nondominant hand. Pulse rate was expressed in a beat to beat interval fashion by measuring the time interval in milliseconds between the second and fifth p-waves of each 6 second measurement interval. Pulse amplitude was expressed as the sum, in millivolts, of the second through the fourth p-wave amplitudes of the pulse pressure curves, during the measurement interval. Skin potential response was picked up using two Beckman silver/silver chloride electrodes placed on the volar surface of the third and fourth digits' distal phalanx of the nondominant hand. It was expressed as the total number of spontaneous skin potential activity bursts of 0.5 K-ohms or greater, occuring during the measurement interval.

Psychometric evaluation of program efficacy was assessed across the variables of Type A/B behavior, locus of control, and manifest anxiety. Type A/B behavior was measured via the college student form of the Jenkin's Activity Survey (form T) [4]. The Rotter Scale [5] was employed to evaluate internal versus external locus of control. Manifest anxiety was quantified by the Taylor Manifest Anxiety Scale [6].

Data collection was carried out for all bionedical and psychometric measures during the first three weeks of each semester for pretest assessment, and during the last three weeks of the semester for post-test results.

Given the fact that subject grouping (program or control) was self-selected and therefore nonrandom, all post-test scores used in the data analysis were residualized based on pretest values, to eliminate any initial variance between the two groups across the assessment variables. The residualization procedure used was that outlined by Bloom [7]. To allow interparametric comparisons, all residualized post-test scores were converted to standard Z scores prior to analysis, using the pretest data as the reference norm.

A three-way ANOVA, across groups, psychophysiological parameters, and stress response dimensions was employed to analyze program efficacy across the biomedical variables, using post-test, residualized Z scores. Psychometric efficacy was analyzed by performing a two-way ANOVA, across groups and psychometric measures, on post-test, residualized Z scores from the three inventories. The ANOVAs were followed by a Newman-Kuels multiple contrast analysis. All significance testing was carried out at the $p \leq .05$ level.

RESULTS

The four tables presented display initial pretest means across both groups and the post-test findings for subjects enrolled in the program and controls. All data is expressed here prior to residualization or standardization. Tables 1 through 3 display the biomedical findings. Table 1 illustrates prestimulus baseline values for all psychophysiological parameters, reflective of the mean resting physiological state or condition of the subjects. Table 2 shows stress

response amplitude findings, the peak amplitude of the subjects' nervous responses to rapid onset stress. Table indicates response duration, or the recovery time required to return to a normal resting state following exposure to the stressor. Table 4 presents the results of the psychometric inventories, indicating changes in behavior; cognitive style, and manifestations of anxious states.

TABLE 1

Psychophysiological Baselines

	Parameter			
	EMG (uv)	PR (msec)	PA (mv)	SPR (# potentials)
Pretest Average	3.1	2347	587	2.3
Post-test: Program	2.4	2322	596	1.3
Post-test: Control	3.0	2341	603	2.7

TABLE 2

Stress Response Amplitude

	Parameter			
	EMG	PR	PA	SPR
Pretest Average	4.3	2122	547	4.6
Post-test: Program	2.9	2092	569	5.8
Post-test: Control	4.4	2133	538	4.2

TABLE 3

Stress Response Duration

	Parameter (seconds)			
	EMG	PR	PA	SPR
Pretest Average	23	42	64	13
Post-test: Program	13	44	58	7
Post-test: Control	27	41	61	16

TABLE 4

Psychometric Data

	Parameter	Jenkins	Rotter	Taylor
Pretest Average		10.1	11.3	19.2
Post-test	Program	10.4	11.2	20.8
	Control	9.8	9.3	14.7

Analysis of Variance followed by Newman-Kuels Multiple Contrast Analysis revealed the following statistically significant post-test differences ($p \leq .05$) between the two groups:

Compared to control subjects, program participants displayed:

1) Lower baseline frontalis muscle tension
2) Lower baseline skin potential response
3) Reduced stress response amplitude for frontalis muscle tension
4) Decreased stress response amplitude for pulse amplitude (adjusted inverse relationship)
5) Increased stress response amplitude for skin potential response
6) Decreased stress response duration for frontalis muscle tension
7) Decreased stress response duration for skin potential response
8) Decreased manifest anxiety
9) Shift toward internal locus of control.

No other one-way comparisons were found to be significant.

DISCUSSION

In relation to the biomedical indicators of program efficacy, all significant findings except one, indicate that the program is effectively equiping participants to decrease reactivity to laboratory stressors compared to controls. The results indicate that across three diverse organ response systems (musculoskeletal, cardiovascular, and electrodermal) program participants were displaying a reduced pattern of activity wich would be indicative of improved resistance to the development of psychosomatic disease, based on the measurement of these psychophysiological precursors.

The one notable exception to this displayed pattern of reduced stress reactivity was the finding that program participants displayed an increase in stress response amplitude in the skin potential response parameter. Although seemingly contradictory to the overall reduction in elicited stress arousal, this finding is not inconsistent with the existing literature on the psychophysiological effects of systematic relaxation training. Goleman and Schwartz [8] noted that experienced meditators do in fact show an increase in response amplitude in electrodermal measures in response to lab stressors. They also display a significant decrease in response duration. This finding has subsequently been interpreted as indicating that the stress management technique was not making the individual numb to environmental stimuli, but was reducing the duration of the response. This seems to give us the best of both conditions. The individual is still responsive to the environment, but the arousal doesn't linger in a potentially pathogenic fashion. Therefore, the results of the biomedical evaluation are consistent with the existing literature on the pattern of physiological responses indicative of reduced pathogenic arousal. Based on this aspect of the program evaluation, it seems to be impacting biological integrity in a positive direction.

From a psychometric perspective, the program under investigation seemed to produce significant reductions in manifest anxiety and a shift towards an internal locus of control in participants compared to controls. Manifest anxiety was assessed in this investigation as the number of physical and cognitive symptoms or manifestations of anxiety, not as the nebulous cerebral construct of perceived anxiety. This reduction in manifest anxiety indicates that the program was effective in reducing the subjective and overt indicators of stress resulting from cognitive maladaptive arousal. The decrease in scores on the Rotter Scale indicates a significant shift toward a more internal locus of control on the part of the program participants compared to controls. Based on the nature of this

measure, this finding would indicate that program participants developed an increased sense of control over the outcomes of their own lives. This may be the most important psychological construct influencing psychosomatic well-being. As Seligman has indicated in his citings of related research into the helplessness phenomenon [8], that learned helplessness, the extreem of external locus of control, can have devistating somatic effects, even precipitating the onset of sudden death. The observed shift to internality by program participants is therefore a highly positive factor potentially reducing the impact of many other pathogenic variables. The fact that no significant change was observed in the Type A/B behavior construct indicates that the observed reduction in measures of experienced stress, on the part of participants, was due to factors other than a direct behavioral style change; perhaps the cognitive shifts and newly learned visceral control skills accounted for the positive changes.

CONCLUSION

Within the limitations of this investigation, the results lead the author to conclude that in relation to several measures of biological integrity and mental well-being, the Controlling Stress and Tension program at the University of Maryland is impacting Human health in a positive direction through stress management. Based on the encouraging results of this initial assessment, two further research projects will be implimented. The first will be an evaluation of alterations in the incidence of psychosomatic complaints and disease and the second will be a longitudinal assessment of long term program impact across the variables outlined here.

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